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A Re-evaluation of the Generic Limits of *Pison* Jurine, and a New Species of the Genus *Aulacophilinus* Lomholdt (Hymenoptera: Crabronidae: Trypoxylini)

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The status of subgenera in the genus *Pison* Jurine is discussed. *Aulacophilinus* Lomholdt and *Entomopison* Menke are restored to genus (revised status). The importance of the mandible in generic discretion is discussed. A new species of *Aulacophilinus* from New Guinea, *A. amblygnathus*, is described. *Pison weiri* Naumann, *P. caliginosum* Turner, *P. mandibulatum* Turner and *P. pyrrhicum* Naumann are transferred to the genus *Aulacophilinus* (all new status). An identification key to the six known species of *Aulacophilinus* is provided.

The Cosmopolitan genus *Pison* has slightly less than 200 species and is one of the largest in the family Crabronidae. As currently interpreted, *Pison* contains a broad diversity of species morphology. The mandible in *Pison* is one of the more complexly variable features of the genus, and it is more diverse than indicated by Bohart and Menke (1976). The morphological diversity in *Pison s.l.* resulted in several authors describing generic taxa: *Pisonoides* Smith (1857); *Krombeiniellum* Richards (1962); and *Entomopison* Menke (1968). In my review of New World *Pison* (Menke, 1988), these genera were considered synonyms of *Pison* and species groups were established for the species diversity in the fauna of the Western Hemisphere.

The purpose of this paper is to discuss the importance of the mandible as a generic character in *Aulacophilinus*, *Pison*, and *Entomopison*. My studies demonstrate some generic taxa considered as synonyms of *Pison* are really valid genera. Species of *Aulacophilinus* have a mandible which has a unique shape shared by both sexes. Thus I have reinstated *Aulacophilinus* as a genus (revised status). Species of *Entomopison* consistently have a large externoventral notch in both sexes, while species of *Pison s.s.* lack a notch or it is weakly formed. I now recognize the Neotropical *Entomopison* as a genus (revised status). The removal of *Aulacophilinus* and *Entomopison* from *Pison* leaves the latter an assemblage that is morphologically diverse. As such it is probably paraphyletic. Further study may suggest breaking up *Pison s.s.* into 2 or 3 additional genera. *Krombeiniellum* is one taxon that might be elevated to genus based on the densely setose eyes.

Lomholdt (1980) described a new genus, *Aulacophilinus*, from the Solomon Islands in the Western Pacific, that he regarded as a close relative of the New World genus *Aulacophilus* Smith because of its petiolate abdomen. Indeed, the abdomen of *Aulacophilus* and *Aulacophilinus* is very similar, but Lomholt's genus lacks the many parallel pleural carinae that characterize *Aulacophilus*. I have studied Lomholdt's type material and find that *Aulacophilinus* is a close relative of *Pison*. The genus differs from *Pison* in the form of the mandible. In both sexes the apex has a rather broad and distinctive cutting edge (Figs. 3, 8). Furthermore, the outer surface of the mandible is rather uniformly and densely covered with short setae in *Aulacophilinus*. This mandible is unique and not

found in any species of *Pison*. I have discovered additional undescribed species of *Aulacophilinus* in the Western Pacific with the same type of mandible, but the abdomen is not petiolate. Thus *Aulacophilinus* contains species that are more like *Pison* in their general facies. The distinctive mandible defines *Aulacophilinus*. The petiolate abdomen of *Aulacophilinus rennellensis* is striking (Fig. 1) but this condition is known in some *Pison s.s.*: *pistillum* Menke, 1988 and *woji* Menke, 1988, both from New Guinea. There are other petiolate or clavate species but the examples just listed are the most extreme. The genus *Pisonoides* was described for *obliteratum* Smith (1857), a petiolate species known from India and Indonesia, but abdominal structure is too variable to be used as a generic character. Other petiolate species like *Pisonoides obliteratum* are the Australian *Pison icariodes* Turner, 1908, and *P. difficile* Turner, 1908. Antropov (1999) synonymized *Aulacophilinus* with *Pison*, a genus with which it is more closely allied. But Lomholdt's genus is here resurrected from synonymy.

Naumann (1990) described and keyed four Australian species of *Pison*, two of which were new, that have an apically truncate mandible as in *Aulacophilinus*. He called the assemblage the *caliginosum* group, and included *caliginosum* Turner, *mandibulatum* Turner, *pyrrhicum* Naumann, and *weiri* Naumann. I have discovered more species with this type of mandible in New Guinea, one of which is described below. All of these species belong in the genus *Aulacophilinus* and are new combinations.

Sources of Material

American Entomological Institute, Logan, Utah (David Wahl)
Bishop Museum, Honolulu, Hawaii (Gordon Nishida)
The Natural History Museum, London, England (Colin Vardy)(BMNH)
Zoological Museum, Copenhagen, Denmark (Ole Lomboldt)

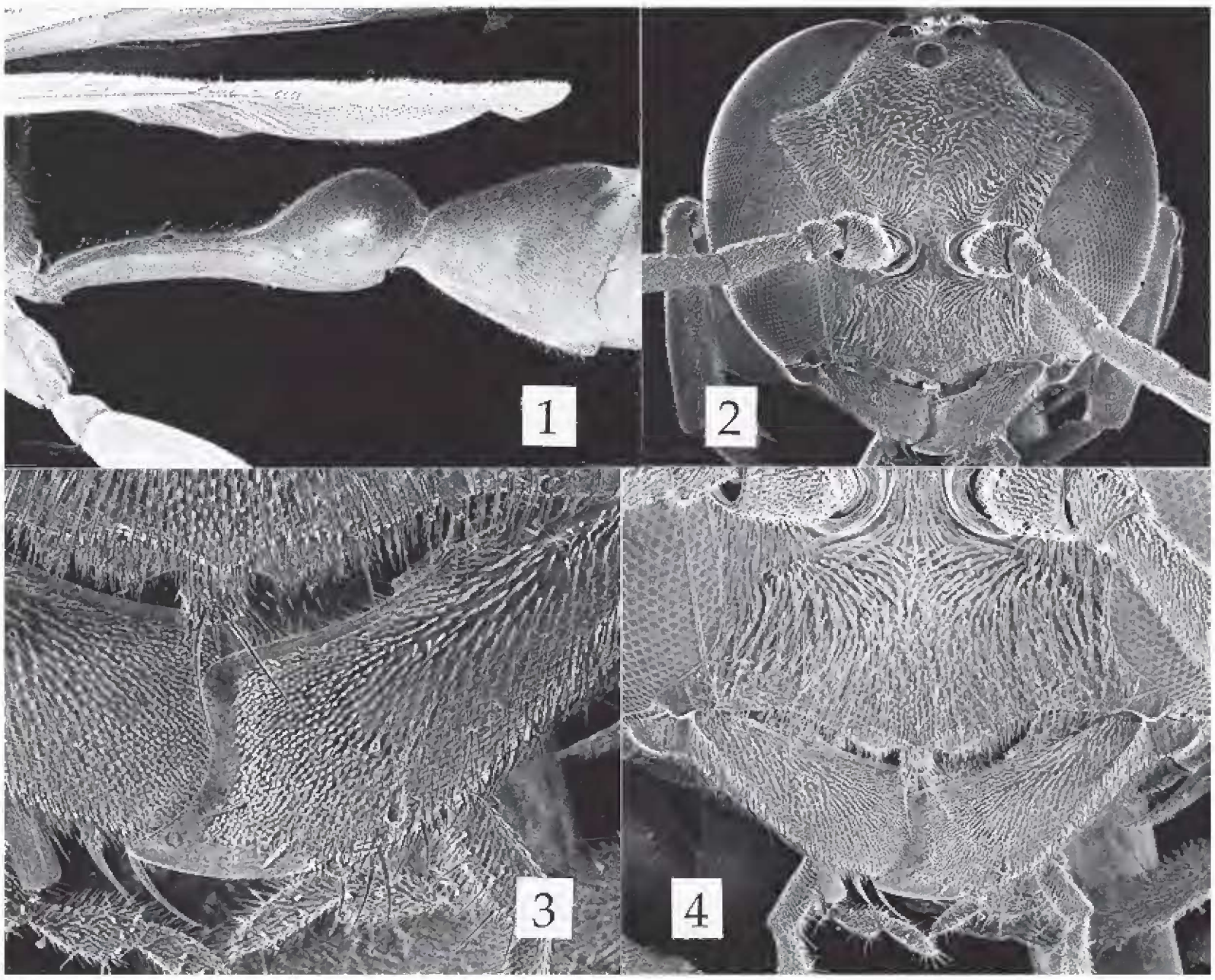
Terminology and Procedures

I follow Bohart and Menke (1976) and Harris (1979) for terms. Scanning electron photographs were made by me at the Smithsonian SEM facility back in the 1980s.

Genus *Aulacophilinus* Lomholdt, revised status

Aulacophilinus Lomholdt, 1980. The Natural History of Rennell Island, British Solomon Islands 8:27. Monotypic.
Aulacophilinus, Antropov, 1999. Zoologischeskiy Zhurnal 78:562. Synonymized *Aulacophilinus* with *Pison*.

When Lomholdt described his new genus, he compared it to the Neotropical genus *Aulacophilus* Turner because of similar abdominal elongation, the presence of only two submarginal cells, and the absence of a carina at the top of the propodeal side. These are superficial resemblances, however, and in my opinion *Aulacophilinus* is more closely allied with *Pison*. In fact Antropov (1999) realized the true affinities of Lomholdt's genus and synonymized it with *Pison*. The peculiar elongate abdominal petiole of *rennellensis* (Fig. 1) is approached or paralleled by several species of *Pison* (*woji* Menke, *pistillum* Menke, *icarioides* Turner, *difficile* Turner). The broad mandible common to the various species discussed here is an apomorphy that in my opinion elevates *Aulacophilinus* to genus. The mandible in this genus is acuminate apically, but the inner (or cutting) edge is broadly expanded in an angular fashion near its apical one-third (Figs. 3, 8). In addition, the margin of the cutting edge is narrowly polished. This smooth rim extends along the truncation and around the sharp mandibular apex (Figs. 3, 7). The ventral (posterior) edge of the mandible is fringed with very short, dense setae. Both sexes share this unique type of mandible,



FIGURES 1–4, *Aulacophilinus rennellensis*, male features. 1, lateral profile of abdomen. 2, front view of head. 3 and 4, mandible, clypeus, and labrum

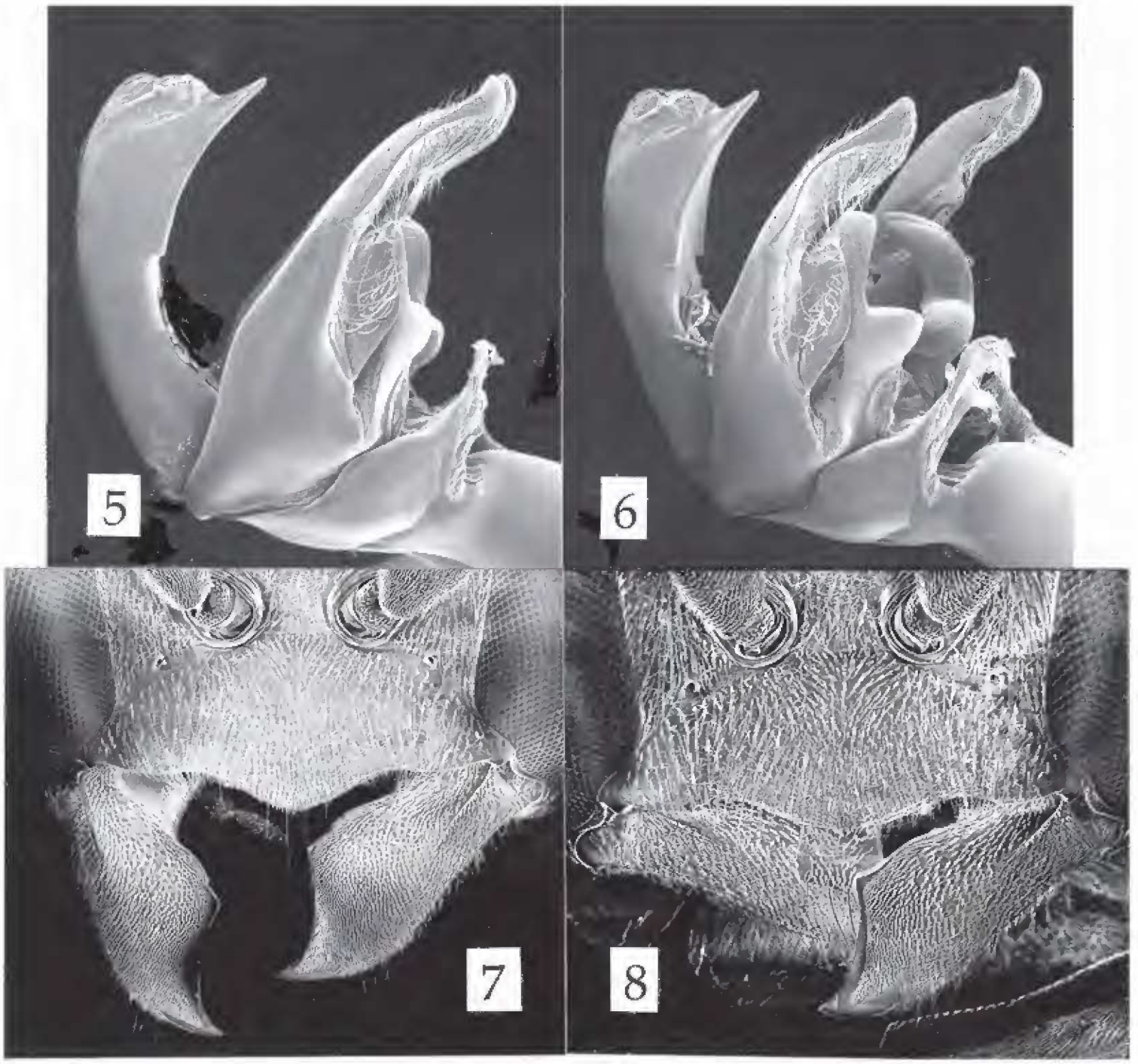
and I agree with Naumann (1990) that this is an apomorphy for *Aulacophilinus*. Another feature common to species of *Aulacophilinus* is a narrow labrum (Figs. 4, 8) and it may prove to be an additional apomorphy.

The species of *Aulacophilinus* are rather diverse morphologically. Two species, *A. caliginosus* and *A. weiri*, have two submarginal cells, the rest three; *A. weiri* has an omaulus on the mesopleuron and a transverse carina on the pronotal collar; two species have a crenulate ridge at the top of the propodeal side (*A. caliginosus*, *A. mandibulatus*); and among the included species the occipital carina varies from a complete circle to interrupted at the midventral line of the head.

Aulacophilinus amblygnathus Menke, sp. nov.

TYPES.— Holotype male: New Guinea: Wau, October 1969, P. Shanahan (American Entomological Institute). Paratypes: one female with same data as holotype (American Entomological Institute); one female, Wau, 1200 m, Nov. 1, 1965, P. Shanahan (Bishop Museum).

DESCRIPTION: *Holotype male*.— Black, shiny except frons and antenna dull, flagellomeres VII-XI pale beneath; clypeus and lower frons with short, appressed silver setae that obscure sculpture; head and thorax with long, erect pale setae except setae in ocellar triangle shorter and black; gaster with short, decumbent, pale setae; wing veins dark brown, membrane slightly infuscate.



FIGURES 5–8, *Aulacophilinus amblygnathus* features. 5 and 6, male genitalia, lateral view, and ¾ view respectively. 7, female clypeus and mandibles. 8, male clypeus, labrum and mandibles.

Upper interocular distance 0.56X lower interocular distance; ocellocular distance 0.22X hindocellus diameter; frons with large, shallow punctures that are 1 to 2 diameters apart, interspaces minutely roughened, dull; flagellum without tyli or other adornments, lengths of flagellomeres I-III equal, each slightly more than twice as long as wide, VI–X only slightly longer than wide; clypeus with broad, obtusely triangular median lobe that ends in small tooth (Fig. 8), edge of lobe thickened laterad (ventral view); labrum narrowly quadrangular, projecting beyond clypeal edge (Fig. 8); mandible broadening to an obliquely, arcuately truncate apex (Fig. 8); occipital carina essentially complete but becoming very low at midventral line, narrowly separated from hypostomal carina. Pronotum with anteromedial round pit that is about 0.5X hindocellus diameter, several irregular transverse rugae behind pit; collar not carinate but with obtuse elevation at middle; scutum punctate, punctures densest anteriorly (0.5 diameters apart), 1 to 2 diameters apart on disk, interspaces imbricate (Harris, 1979); scutellum similarly punctate and sculptured; mesopleuron coarsely punctate, punctures 0.5–2 diameters apart, interspaces smooth except minutely roughened

on venter, hypoepimeral area horizontally rugosopuncatate; metapleural flange narrowly lamelliform; propodeum mostly smooth, punctate, most sparsely so on side (1–1.5 diameters apart), punctures of dorsum finer than those on scutum; base of dorsum with short, strong ridges, dorsum with series of short, transverse rugae along midline; propodeal side not delimited dorsad by carina but there is a vague linear series of short transverse rugae between petiole socket and spiracle. Gaster more finely punctate than thorax, interspaces smooth, punctures coarsest on segment I, resembling pinpricks on last few segments, sterna unspecialized, VIII concavely truncate apically. Male genitalia (Figs. 5, 6). Hindtarsomere I swollen beneath subapically in lateral profile, distal third flattened ventrally, this area densely covered with very short white setae, distal two thirds of II covered with similar setal patch ventrally, III–IV with plantulae. Forewing with three submarginal cells, recurrent vein I ending on submarginal cell I but nearly interstitial, recurrent vein II ending on submarginal cell III, separated from II by about an ocellus diameter, forewing media diverging beyond cu-a. Length 6.5 mm.

Paratypes: female (two).— Color as in male except antenna completely black, and appressed silver setae of clypeus sparser, not obscuring sculpture.

Similar to male except upper interocular distance 0.47–0.48X lower interocular distance; ocellocular distance 0.07–0.10X hindocellus diameter; flagellomeres VII–IX nearly 2X as long as wide; clypeal lobe more angular (Fig. 7); cutting edge of mandible with small indentation basad of truncation (Fig. 7); propodeal side not delimited dorsad in any way; hindtarsomeres I-II unmodified; recurrent vein I ending on submarginal cell I about ocellus diameter from II; Length 8 mm.

DISCUSSION.— *Aulacophilinus amblygnathus* is the only member of *Aulacophilinus* from New Guinea with three submarginal cells in the forewing. Others with three submarginal cells known to me are *mandibulatus* and *pyrrhicus*, both of which are found in Australia.

ETYMOLOGY.— *Amblygnathus*, a noun, is based on the Greek words amblys (= blunt, truncate) and gnathos (= jaw), a reference to the peculiar mandible.

Key to Species of *Aulacophilinus*

1a. Forewing with two submarginal cells 2
1b. Forewing with three submarginal cells 4

2a. Gastral segment I in the form of a slender petiole with tergum swollen only at apex (Fig. 1); propodeal side not delimited above by carina; Solomon Islands (Rennell I.). . . . . *rennellensis* Lomholdt
2b. Gaster sessile, segment I not forming a petiole; propodeal side sometimes delimited above by carina; Australia, Norfolk I 3

3a. Mesopleuron with omaulus; face, scutum and mesopleuron areolate rugulose; pronotum with transverse crenulate carina; northern Australia . . . . . *weiri* (Naumann)
3b. Mesopleuron without omaulus; face, scutum and mesopleuron punctate; pronotum without transverse carina; widespread in Australia, Norfolk I. . . . . *caliginosus* (Turner)

4a. Body entirely black; New Guinea . . . . . ***amblygnathus* sp. nov.**
4b. Body not entirely black, either mandibles or legs and abdomen extensively amber colored; Australia 5

5a. Mandible amber colored, abdomen and legs black; ocellocular distance 0.75 or more times hindocellus diameter; frons densely punctate, interspaces dull; propodeal side delimited dorsad by carina that may be irregular and crenulate; anterior veinlet of third submarginal cell about one third length of posterior veinlet; southwestern Australia . . . . . *mandibulatus* (Turner)

5b. Mandible black, abdomen and legs largely amber colored; ocellocular distance less than half diameter of hindocellus; frons coarsely punctate-areolate, interspaces shiny; propodeal side without carina dorsad; anterior veinlet of third submarginal cell half length of posterior veinlet; northern and eastern Australia. . . . . *pyrrhicus* (Naumann)

Notes on the types of *A. rennellensis*

I studied the holotype female and paratype male in 1989. The mandible of the female has a polished edge from apex along lower side as in other species of the genus, but the cutting edge seems to lack this. It is dull (worn?). The male, on the other hand, has the usual polished cutting edge (Figs. 3, 4). The male antenna has polished, elevated tyli on flagellomeres I–IV (not II–V as stated by Lomholdt who apparently regarded the pedicel as flagellomere I). The male clypeal edge is quite thick. Seen in ventral view it is about an ocellus diameter wide. The male has a tiny labrum just like the female (Fig. 4). It is about as wide as an ocellus diameter. In the female, the pronotum has a round anterodorsal pit that is smaller than ocellus. The pit is within a broad flat but not highly polished area bordering the anterior margin. This flat area is suggestive of the lamella of the *pilosum* group of *Entomopison*, but it is not a lamella, nor is it polished. It is setose. Its hind margin is slightly elevated over a length that is about two thirds width of collar. The occipital carina is a complete circle that is well separated from hypostomal carina, the two separated by about an ocellus diameter. Inner carina of hindcoxa is diagonal and widely separated from apical U-notch for trochanter, outer carina absent. The hindcoxa of *amblygnathus* is intermediate between *rennellensis* and *mandibulatus*. The hindbasitarsis of the female is ordinary. The male abdomen is shown in Fig. 1.

Notes on type of *A. mandibulatus* (Turner), 1916

I studied the lectotype of Turner's species many years ago (BMNH). The following notes are based on this specimen as well as other material.

The amber mandible (and clypeal apex in female) is immediately diagnostic. The propodeal side has a well formed carina at the top in the female, but in the male it is somewhat irregular and more crenulate. The ocellocular distance is broader than in any of the other species in the *mandibulatus* group (i.e., *amblygnathus* and the other New Guinea species), being almost as broad as the ocellar diameter in the female, and broader than the ocellocular distance in the male. The frons is strongly swollen just above the sockets, somewhat wedgelike, forming two humps when viewed from below (*pyrrhicus* is weakly this way). The New Guinea species are merely rounded off in this area. The frons is closely punctate, punctures less than diameter apart, some almost contiguous, and the interspaces are dull. The scutum is similarly punctate, but more uniformly nearly contiguous and the interspaces are somewhat shiny. The mesopleural punctures are also dense, but slightly larger and the interspaces are even shinier. The propodeal dorsum has a median carina that is met by many transverse carinae that are mostly perpendicular and which extend over the middle third of the surface. These carinae fade into dense striatopunctation laterad. The propodeal side is shiny and densely punctate, their size about as on scutum (smaller than mesopleural punctures). The abdominal terga are shiny and densely punctate, the punctures being smaller than anywhere else. The hindcoxa has a long inner carina that is essentially parallel with long axis of segment, and narrowly separated from apical U-shaped emargination. The outer carina is strong on apical half. The hindbasitarsis is not straight like *amblygnathus*. It has a slight curve from base to apex in lateral profile (the hind face when seen in lateral profile has a concave curvature). The male hindbasitarsis is nearly straight. The male antenna lacks tyli or other adornments.

Genus *Entomopison* Menke, revised status

Entomopison Menke, 1968. Los Angeles County Museum Contributions in Science (135):5. Type species *Pison pilosum* Smith, 1873, original designation.

Entomopison is restricted to the New World tropics and contains the following 11 species: *alini* Antropov,1996, *aureofaciale* Strand, 1910, *convexifrons* Taschenberg, 1870, *cooperi* Menke, 1988, *gnythos* Menke, 1988, *longicorne* Menke, 1988, *oaxaca* Menke, 1988, *pilosum* F. Smith, 1873, *sphaerophallus* Menke, 1988, *vincenti* Menke, 1988, and *wasbaueri* Menke, 1988. I (Menke 1988) segregated them into two species groups: the *convexifrons* group and the *pilosum* group. *Pison alini* Antropov (1996), belongs in the *convexifrons* group. Elevation of *Entomopison* to genus makes the contained species all new combinations.

Genus *Pison* Jurine

Pison Jurine in Spinola, 1808:255. Type species *Pison jurini* Spinola 1808, monotypic (properly *jurinei* Spinola, = *Alyson ater* Spinola, 1808).

Pisonoides Smith, 1857. Type species *Pison obliteratum* F. Smith1859, monotypic.

Krombeiniellum Richards, 1962:118. New name for *Paraceramius* Radoszkowski, 1887, nec *Paraceramius* Saussure, 1854. Type species: *Paraceramius koreensis* Radoszkowski, 1887 (junior synonym of *agile* (F. Smith), 1869).

For complete list of generic synonyms see Bohart and Menke (1976). Pulawski's online catalog of Crabronidae lists 198 species of *Pison*. However, a few of these are now in *Aulacophilinus*, 11 are now in *Entomopison*, and many others await descripton. *Pison* likely has more than 200 species worldwide.

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Michael Ohl critically reviewed the manuscript and offered helpful suggestions. Wojciech Pulawski helped with literature and translated Antropov's 1999 Russian paper for me. An anonymous reviewer also provided additonal helpful recommendations.

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